Reply Comments of SolarCity
on the Net Energy Metering Study Phase 1 Methodology
November 15, 2012

Introduction

Pursuant to the directions provided by the Energy Division of the California Public Utilities Commission ("Commission"), SolarCity Corporation submits this informal reply to other parties' comments on the proposed Scope of Work (SOW) and methodology for the Commission's Net Energy Metering (NEM) Study (Phase 1 Methodology). The proposed SOW and methodology was presented by Energy and Environmental Economics, Inc. ("E3") at the Commission's October 22, 2012 workshop in which SolarCity participated. SolarCity appreciates this opportunity to submit reply comments.

SolarCity is California's leading full service solar power and energy efficiency provider for homeowners and businesses - a single source for engineering, design, financing, installation, monitoring, and support. SolarCity is a member of the Solar Energy Industries Association (SEIA) and supports the Joint Parties' separate reply comments.

The Study Should Analyze NEM from Both Export-Only and All-Output Perspectives. SolarCity agrees with the comments of the Joint Parties that focusing on the power exported to the grid from NEM systems (the "export-only" case) is the correct way to analyze the costs and benefits of NEM. SDG&E and PG&E assert that the Study should consider the entire output of NEM systems (the "all-output" case) only, and that it should not examine the costs and benefits of NEM from the "export-only" perspective. Limiting the study to the entire output of NEM systems, as proposed by SDG&E and PG&E, would unfairly prejudice the results of the study and is not required by AB 2514. Furthermore, it would implicitly prejudge critical legal and policy issues that should be decided by the Commission. E3's Proposed SOW, which would analyze NEM from both perspectives (the export-only case and the all-output case), is an acceptable way to comply with AB 2514. The Study should provide the Commission with the information it needs to fully assess costs and benefits and to compare the results to the CPUC's 2010 NEM Cost-Effectiveness Evaluation, which analyzed only the export-only scenario.

T&D Avoided Costs Should Be Included in the Study. The utilities present a variety of arguments against incorporating avoided T&D costs into the NEM study. The T&D costs that NEM allows the utilities to avoid extend beyond deferred T&D capacity costs, as explained below. SolarCity agrees with E3's approach to include avoided T&D in the base case and disagrees with parties that would either relegate it to a sensitivity analysis, or disregard it for NEM customers on residential circuits.

Correlation between solar PV output and circuit peaks supports recognition of avoided T&D costs in E3's base case. Studies performed by *utilities* have shown PV system value in deferring transformer and transmission line upgrades, extending equipment maintenance intervals, reducing line losses, and improving distribution reliability, all of which result in cost savings.[1]

[1] T. Hoff, D.S. Shugar; "The value of grid-support photovoltaics in reducing distribution system losses,"

More recent studies show that solar PV can also extend distribution equipment life (fewer load-tap changes, reduced thermal heating of transformers and reduced T&D congestion).[2] In the same way that grid planners use statistical methods to predict load, statistical methods can be used to accurately predict the T&D benefits of NEM technologies. Deployed intelligently on the correct phases, PV could also improve phase balancing.

SolarCity supports the use of the current E3 avoided cost model and suggests that the model should be updated to include the additional T&D benefits of advanced inverter features under the IEEE 1547.8 proposed standard. This standard includes VAR control for improved voltage regulation, and low-voltage and frequency ride-through to improve reliability during critical dips in frequency and voltage. These features improve grid integration of DG and reduce the need for infrastructure improvements under high penetration scenarios. Once the IEEE 1547.8 standard is ratified, inverters can be certified to provide these proposed benefits.

SCE and SDG&E both recognize that there can be a strong correlation between solar PV output and individual circuit peaks.[3] As SCE notes, there are significant benefits associated with PV systems owned by commercial & industrial (C&I) customers. Those systems, on average, reach 56% to 78% of maximum output at times of system peak, which is coincident with the peaks on many circuits that are predominantly made up of C&I load.[4] SCE's Coincidence Study shows that solar PV helps reduce circuit peaks. This suggests that, when there is C&I load on a circuit, solar PV on either commercial or residential buildings has significant T&D value.

Accordingly, SolarCity strongly disagrees with SCE, PG&E, SDG&E and TURN that T&D avoided costs should be disregarded or severely discounted based on a generalized characterization of PV output relative to peaks on "residential" circuits.[5] Arguments for discounting or dismissing T&D deferral value for residential solar customers, or on residential circuits, ignore the fact that load on many of circuits comes from a mix of customer classes.

Finally, SolarCity concurs with SEIA that E3's allocation of avoided T&D costs based on weather is consistent with Commission practice for determining cost-effectiveness of DG resources and that E3 should not fundamentally alter its approach now.

T&D Upgrade Costs are Minimal or Non-existent for Interconnecting Solar at the Studied Penetration Levels. As discussed above, transmission and distribution system upgrade costs, as

---

Energy Conversion, IEEE Transactions, vol.10, no.3, pp.569-576, Sept. 1995; Shugar, D.S.; "Photovoltaics in the utility distribution system: The evaluation of system and distributed benefits," Photovoltaic Specialists Conference, 1990, Conference Record of the Twenty First IEEE , pp.836-843 vol.2, 21-25 May 1990; T. Hoff, D.S. Shugar; "The value of grid-support photovoltaics to substation transformers," Proceedings for 1994 IEEE/PES winter meeting.

[2] Mousavi Agah, S.M.; Askarian Abyaneh, H.; "Quantification of the Distribution Transformer Life Extension Value of Distributed Generation," Power Delivery, IEEE Transactions, vol.26, no.3, pp.1820-1828, July 2011.

[3] *See, e.g.,* SCE Comments on SOW at 4; SDG&E Comments on SOW at 9.

[4] SCE Comments on SOW at 4.

[5] *See, e.g.,* SCE Comments on SOW at 4; SDG&E Comments on SOW at 9; TURN Comments on SOW at 3, PG&E Comments on SOW at 2.

pertaining to NEM, are of no real concern today and should not be significant even at the full 5% NEM statutory cap. Distributed PV at these penetration levels have negligible fault current contribution,[6] minimal impact on voltage profile,[7] and essentially no risk of unintentional islanding when using UL-1741 inverters.[8] At less than 10% penetration, NREL states, "some proactive design considerations, mostly minor changes such as slower reclosing" may be the only thing needed to accommodate distributed PV.[9] PG&E's comments state, "there is anecdotal evidence that voltage problems ensure [with significant penetration on certain local circuits] requiring system upgrades to accommodate the NEM exports." This comment should be contrasted with a PG&E presentation at the *PV America* conference in March 2012, to the effect that, "Generally, few impacts today despite the relatively high number of PV systems" and that any problems that do arise can be addressed by *setting adjustments* on distribution system equipment. Slide 8 of the presentation shows there is likely more than adequate capacity on most feeders to accommodate PV penetration up to the 5% cap. PG&E cannot have it both ways.

Integration costs are minimal and should not be included in the study. SolarCity objects to PG&E's proposal to assume an integration cost of $8.50 per MWh for PV resources. Studies by the University of California, San Diego[10], Sandia National Laboratory, and Lawrence Berkeley National Laboratory[11] have shown that as geographic dispersion of solar NEM technologies increases, there is a significant reduction in ramps, especially at short time scales. At moderate geographic scales, site-to-site correlation of NEM PV generation is minimal, meaning requirements for additional regulation and ramp may be less than expected. Additionally, the largest NEM PV ramps are due to diurnal patterns (the rising and setting of the sun) and counterbalance load ramps. As PG&E acknowledges, the Commission has yet to adopt <u>any</u> such integration adder for use in the RPS program so it would be unfair to apply such costs to NEM.

Include Sensitivity Using 100% of the Cost Premium for Renewable Generation. The Joint Parties recommend an additional scenario that applies 100% of the renewable premium to generation from renewable DG resources. Solar City supports this proposal. Renewable energy

---

[6] J. Keller, B. Kroposki; "Understanding Fault Characteristics of Inverter-Based Distributed Energy Resources", NREL Technical Report, NREL/TP-550-46698, pp.18-24, January 2010.
[7] Thomson, M., Infield, D.G., "Impact of widespread photovoltaics generation on distribution systems," Renewable Power Generation, IET , Vol.1, No.1, pp. 33-40, March 2007.
[8] Chicco, G.; Napoli, R.; Spertino, F.; "Experimental evaluation of the performance of grid-connected photovoltaic systems," Electrotechnical Conference, 2004. MELECON 2004. Proceedings of the 12th IEEE Mediterranean, Vol.3, No., pp. 1011- 1016, 12-15 May 2004; Z. Ye, M. Dame, B. Kroposki; "Grid-Connected Inverter Anti-Islanding Test Results for General Electric Inverter-Based Interconnection Technology", NREL Technical Report, NREL/TP-560-37200, pp.7-8, January 2005.
[9] M. McGranaghan, T. Ortmeyer, D. Crudele, T. Key, J. Smith, P. Barker, "Renewable Systems Interconnection Study: Advanced Grid Planning and Operations," Sandia Technical Report, SAND2008-0944 P, pp. xi, February 2008.
[10] M. Lave, J. Stein, A. Ellis, "Analyzing and Simulating the Reduction in PV Power plant Variability Due to Geographic Smoothing in Ota City, Japan and Alamosa, CO," Conference Presentation, 38th IEEE Photovoltaic Specialists Conference, June 2012.
[11] A. Mills, R. Wiser, "Implications of Wide-Area Geographic Diversity for Short-Term Variability of Solar Power," LBNL-3884E, September 2012.

production beyond the RPS requirement clearly has direct monetary benefits to the electric system and economy.

E3's Retail Rate Escalation Assumptions Are Appropriate. SolarCity agrees with E3 that "historical rate escalation may not be the best guide in the current policy environment."[12] Indeed, residential rate design has undergone significant changes since 2001 and recent General Rate Cases suggest that upper-tier rates may be trending downward as the IOUs move to correct for historic upper-tier rate escalation. Given this trend, and the fact that rate design continues to evolve, SolarCity disagrees with PG&E's suggestion that "any rate increases resulting from cost shifts from customers installing NEM, should only be applied to tiers 3 and above."[13] While SB 695 limits annual rate increases for Tier 1 and Tier 2 customers, it does allow increases relative to inflation (3-5% per year).[14] Thus, the rate of increase allowable under law is more than the escalation rate of 2.7% per year that E3 identified in the 2010 LTPP. SolarCity agrees with SEIA that it is reasonable to assume 2.7% increases for all rate tiers.

Study Must Assess Costs and Benefits for Both Participants and Nonparticipants. SolarCity supports IREC's position that the NEM study must quantify the cost-effectiveness of NEM as a whole, considering the perspectives of both "participants" and "nonparticipants." As IREC notes, this requirement can be met by using the Total Resource Cost (TRC) test, an established measure used to evaluate the cost-effectiveness of energy efficiency programs. We believe a TRC assessment of NEM is the most appropriate methodology.

Accordingly, we believe that the NEM study should include and quantify the following direct and indirect benefits of NEM:

- **Black-out prevention & power reliability**: many authors identify the potential reliability benefits of PV generation and the role it plays in mitigating blackouts.[15]
- **Avoided morbidity and mortality associated with fossil-fuel generation**: the health care burden associated with fossil generation has been well documented.[16]
- **Increased welfare and productivity**: the above health care burden directly impacts the welfare and economic productivity of children and working adults.[17]
- **Avoided environmental compliance costs:** distributed renewable generation typically avoids or reduces environmental compliance costs including air and water quality controls, air pollution offsets and other mitigation associated with the impacts of fossil fuel generation.
- **Avoided environmental, safety and economic costs**: distributed renewable generation helps avoid accidents, pollution and economic loss associated with the extraction, transportation,

[12] E3 Net Energy Metering Cost-Benefit Study: Phase 1 Scope and Method at 20 (October 16, 2012).
[13] PG&E Comments on SOW at 2.
[14] Calif. Public Util. Code § 739.9(a).
[15] "Energy, Economic and Environmental Benefits of the Solar America Initiative." S. Grover. National Renewable Energy Laboratory. Pp. 25 August 2007. (http://www.nrel.gov/docs/fy07osti/41998.pdf).
[16] See "The Health Costs of Inaction with Respect to Air Pollution." Organization for Economic Cooperation and Development, Environmental Working Papers, No. 2. Pascale Scapecchi June 2008; and "The Benefits and Costs of the Clean Air Act from 1990 to 2020 [Summary Report]", Office of Air and Radiation, U.S. Environmental Protection Agency, March 2011.
[17] "The Benefits and Costs of the Clean Air Act from 1990 to 2020 [Summary Report]", Office of Air and Radiation, U.S. Environmental Protection Agency, March 2011.

distribution, and processing of natural gas.[18] Methane losses from transmission and distribution pipelines contribute to the state's greenhouse gas inventory and gas transmission poses risk of explosion and fire. In addition, gas production sites in California release methane and other air pollution emissions, and risk water contamination and land use disturbances affecting recreation and wildlife.

- **Reduced water consumption**: the literature is replete with documentation of the water intensity of electricity production by fossil generation. For example, according to the American Water Works Association, household water consumption associated with energy use is greater than all other water uses combined. Approximately 25 gallons of water are used to produce 1 kwh of electricity.[19] In 2010, the U.S. EPA estimated that fracking shale wells can use anywhere from 2 to 10 million gallons of water per well.[20]
- **Improved residential and recreational visibility benefits due to pollution reduction**: many studies have quantified the increased benefits associated with improved visibility due to emission reductions from power generation. Increasing DG renewable generation, including NEM systems, is one strategy for meeting U.S. EPA visibility impairment requirements that are expected to result in $67 billion in residential and recreational visibility benefits in 2020.[21]

Increased employment and downstream economic effects: the number of solar jobs created in California across the entire solar value chain, including sales, finance, installation, and O&M, are significant. NEM supports many of the more than 25,000 solar jobs in California.[22]

Base and High Gas Cost Scenarios. Solar City supports E3's proposal to include a High Gas Cost sensitivity and Joint Parties' proposal to use the 2009 Market Price Referent (MPR) gas cost scenario as a reasonable High Gas Cost sensitivity.

Conclusion

SolarCity appreciates the opportunity to submit these reply comments.

_____/ s /_____
Sanjay Ranchod
Director of Government Affairs & Senior Counsel
3055 Clearview Way
San Mateo CA 94402
650-332-0463
E-mail: sranchod@solarcity.com

[18] The largest user of natural gas is electricity generation, using about half of all natural gas in California. http://energyalmanac.ca.gov/naturalgas/.

[19] http://spectrum.ieee.org/energy/environment/how-much-water-does-it-take-to-make-electricity; accessed November 13, 2012.

[20] "The Hidden Costs of Electricity: Comparing the Hidden Costs of Power Generation Fuels." Synapse Energy Economics. G. Keith et al. September 2012.

[21] See "Summary Report" referenced in footnote 16 at pp.18. These benefits alone exceed the Clean Air Act's total compliance cost of $65 billion in 2020.

[22] National Solar Jobs Census 2011, The Solar Foundation. October 2011.